STARS

Ship Tracking and Routing System

The Future of U.S. Navy Ship Routing

STARS

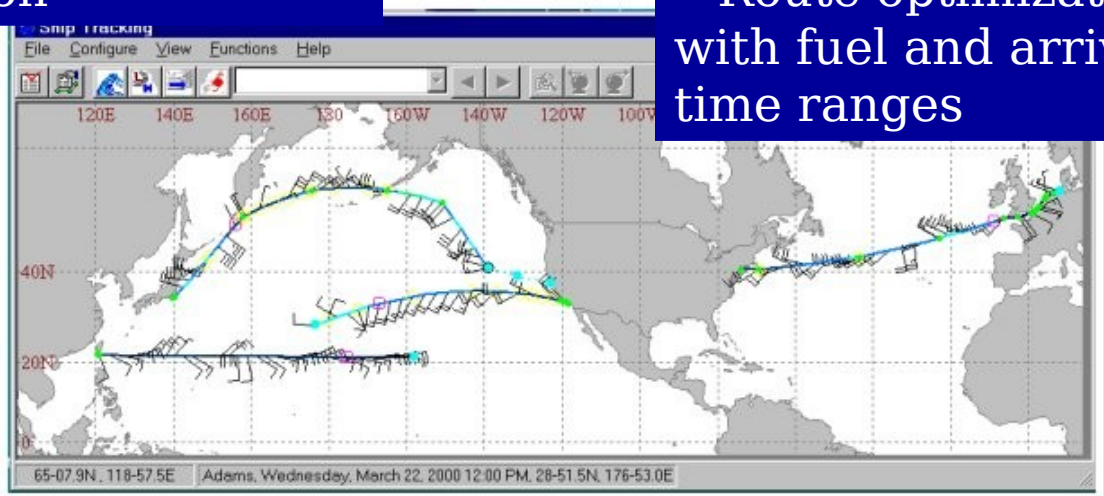
Benefits over Current Techniques

Current

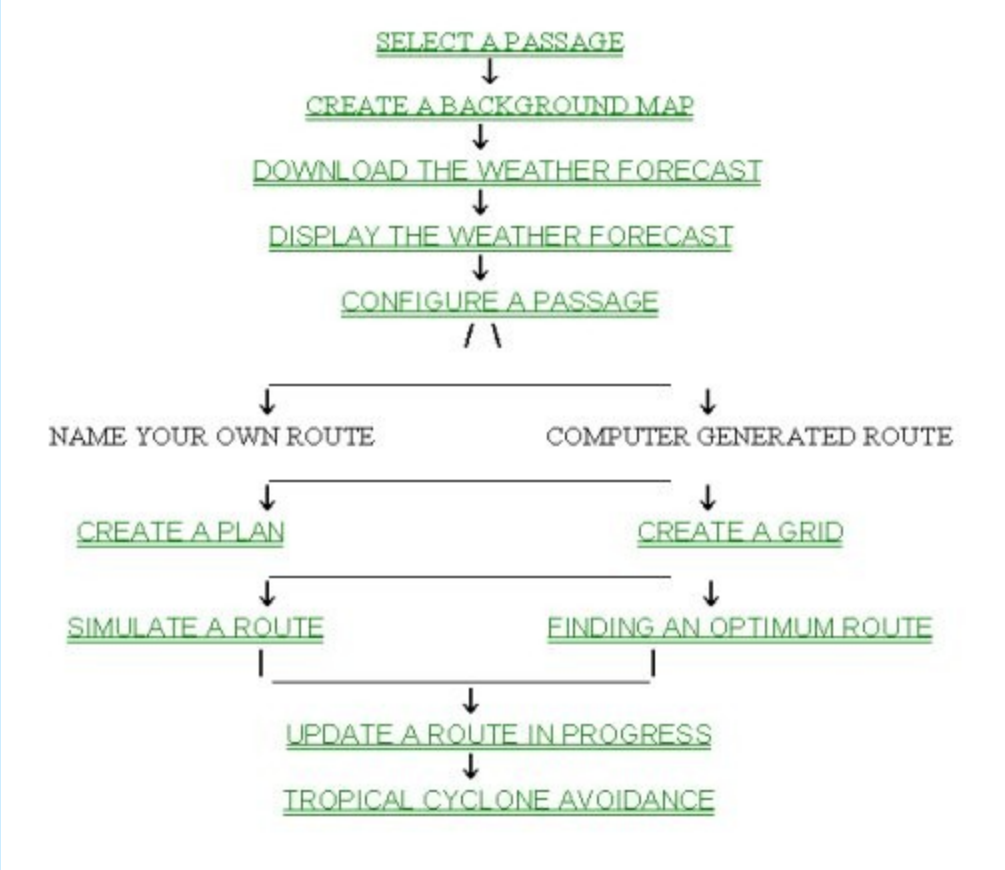
- Uses maximum head/beam/following seas and true wind limits as routing criteria
- Dead reckons ship positions with constant speeds regardless of wind/waves
- No automatic route optimization

STARS

- Uses ship motion response and safe operating envelope as routing criteria
- Dead reckons by simulating voluntary and involuntary speed reduction due to weather
- Route optimization with fuel and arrival time ranges



STARS Methodology

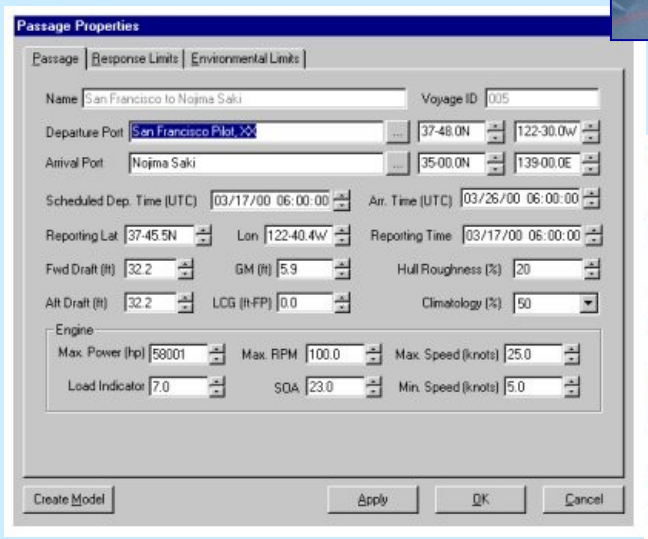


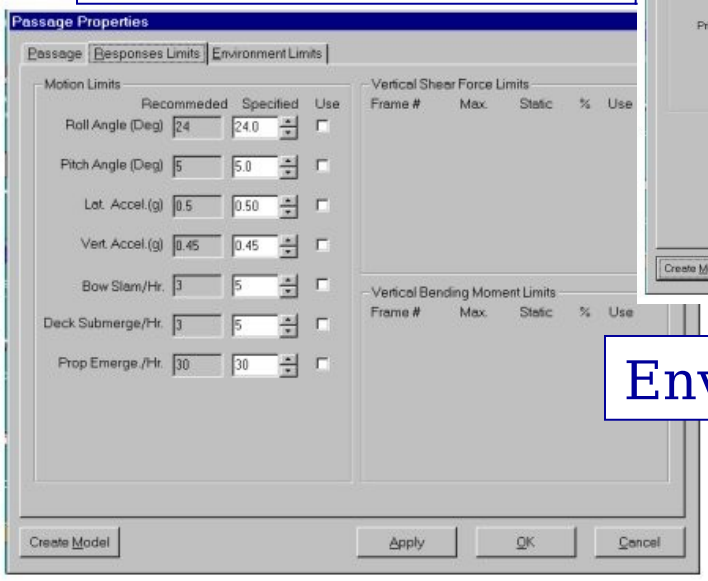
Defining the Safe Operating Envelop

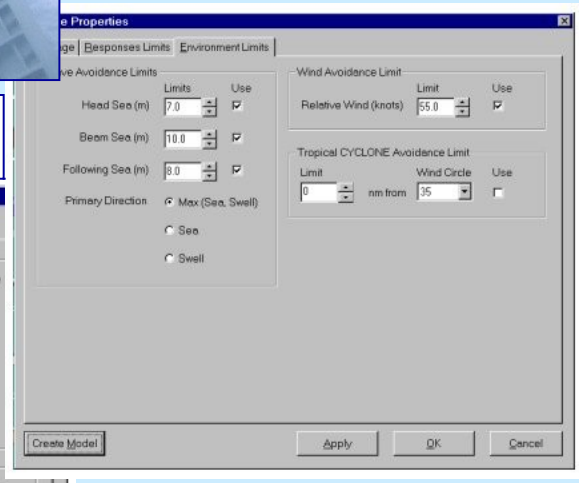
Ship Loading Informat

Motion Parameters

Environmental Parame

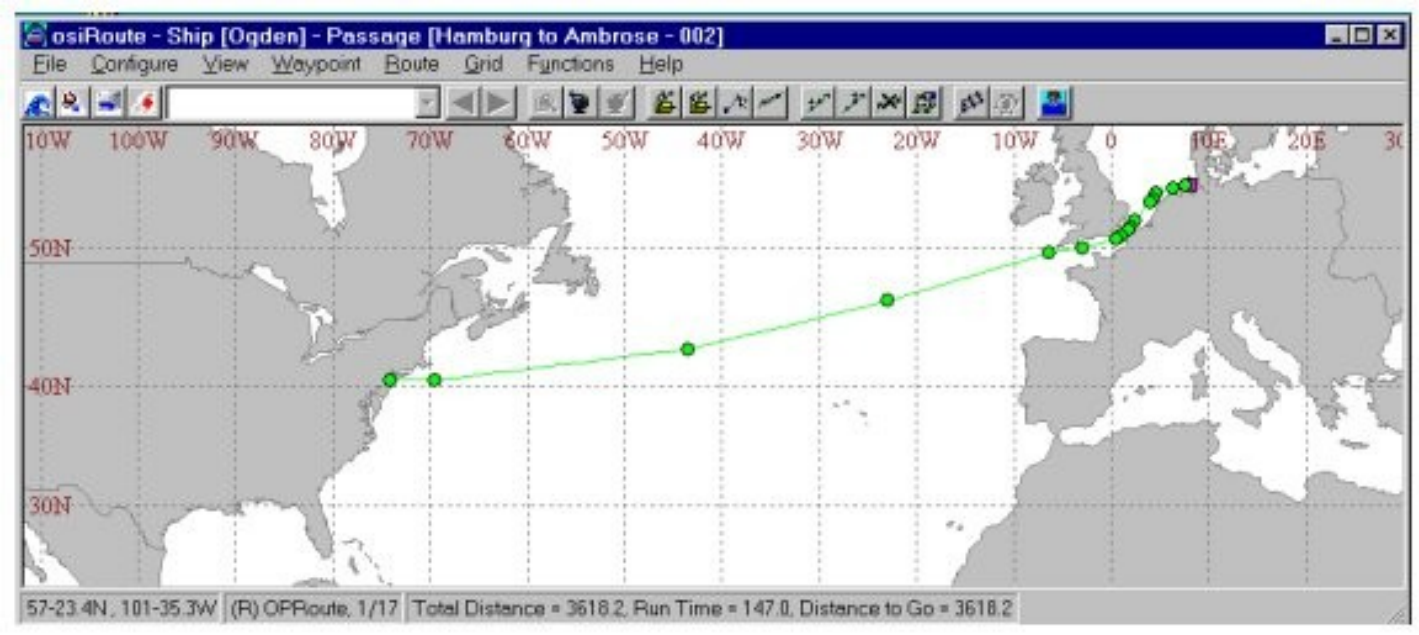




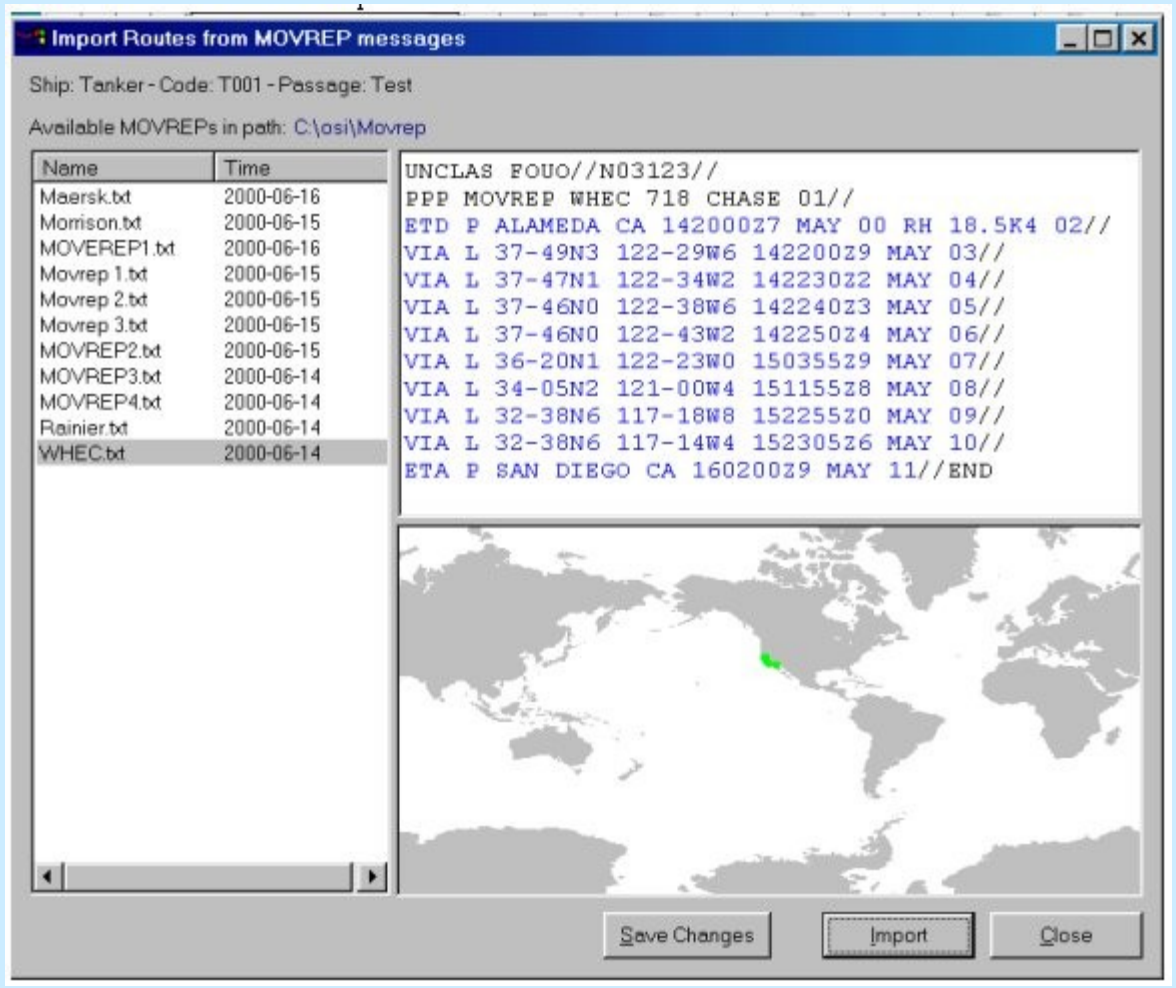


Mission Planning

- Easy to use interface to create and modify routes
- Point and click route creation

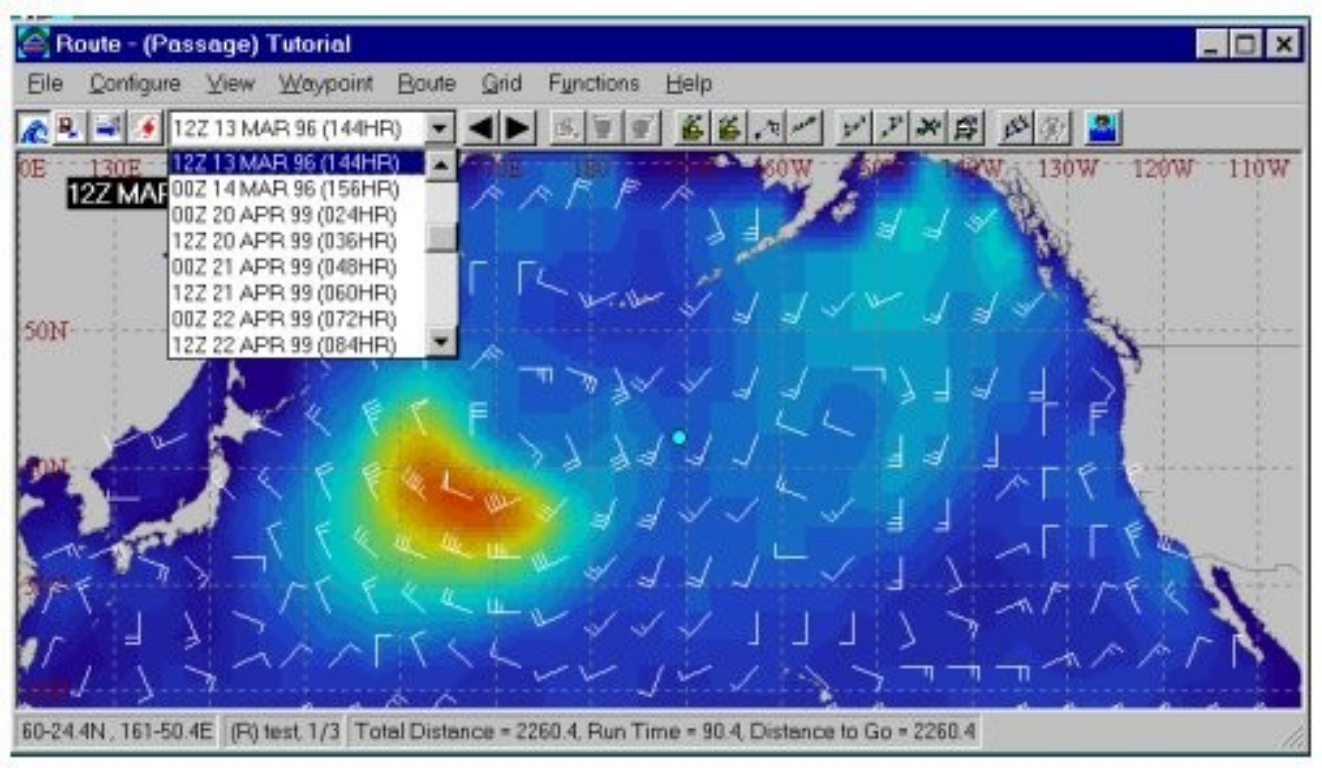

osiRoute - Ship [Ogden] - Passage [Hamburg to Ambrose - 002]
File Configure View Waypoint Route Grid Functions Help
10W 100W 90W 80W 70W 60W 50W 40W 30W 20W 10W 0 10E 20E
50N
40N
30N
57-23.4N, 101-35.3W
(R) OPRoute, 1/17
Total Distance = 3618.2, Run Time = 147.0, Distance to Go = 3618.2

Ingest of MOVREPs

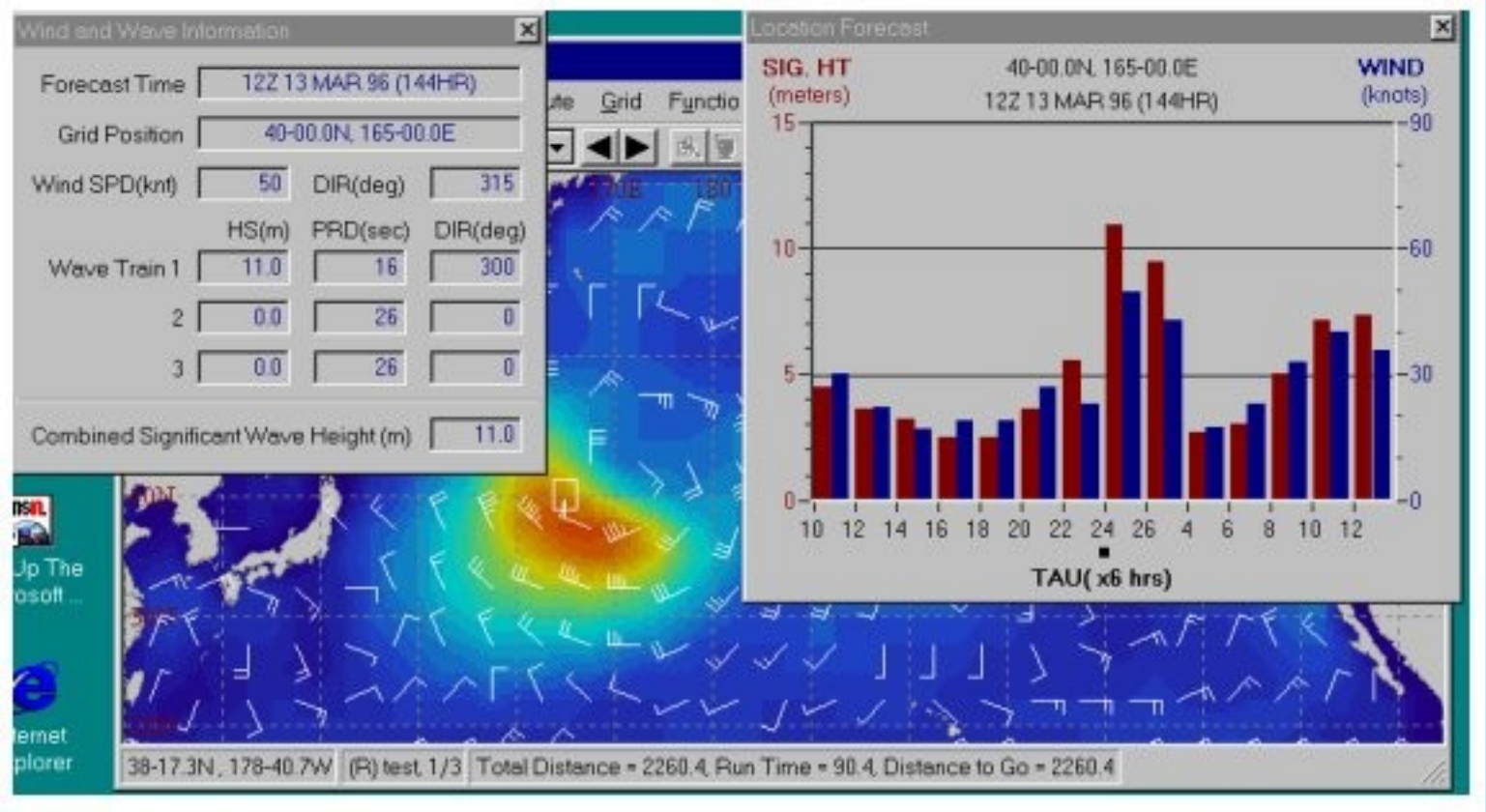

Import Routes from MOVREP messages
Ship: Tanker - Code: T001 - Passage: Test
Available MOVREPs in path: C:\osi\Movrep
Name
Time
Maersk.txt 2000-06-16
Morrison.txt 2000-06-15
MOVEREP1.txt 2000-06-16
Movrep 1.txt 2000-06-15
Movrep 2.txt 2000-06-15
Movrep 3.txt 2000-06-15
MOVREP2.txt 2000-06-15
MOVREP3.txt 2000-06-14
MOVREP4.txt 2000-06-14
Rainier.txt 2000-06-14
WHEC.txt 2000-06-14
UNCLAS FOUO//N03123//
PPP MOVREP WHEC 718 CHASE 01//
ETD P ALAMEDA CA 142000Z7 MAY 00 RH 18.5K4 02//
VIA L 37-49N3 122-29W6 142200Z9 MAY 03//
VIA L 37-47N1 122-34W2 142230Z2 MAY 04//
VIA L 37-46N0 122-38W6 142240Z3 MAY 05//
VIA L 37-46N0 122-43W2 142250Z4 MAY 06//
VIA L 36-20N1 122-23W0 150355Z9 MAY 07//
VIA L 34-05N2 121-00W4 151155Z8 MAY 08//
VIA L 32-38N6 117-18W8 152255Z0 MAY 09//
VIA L 32-38N6 117-14W4 152305Z6 MAY 10//
ETA P SAN DIEGO CA 160200Z9 MAY 11//END
Save Changes
Import
Close

STARS Weather Display

- Imports METCAST grib data
- Color coded wind and wave, surface pressure and 500 mb height contour charts
- Color coded tropical cyclone wind circles
- Global monthly wind/wave climatology
- Full zoom capability

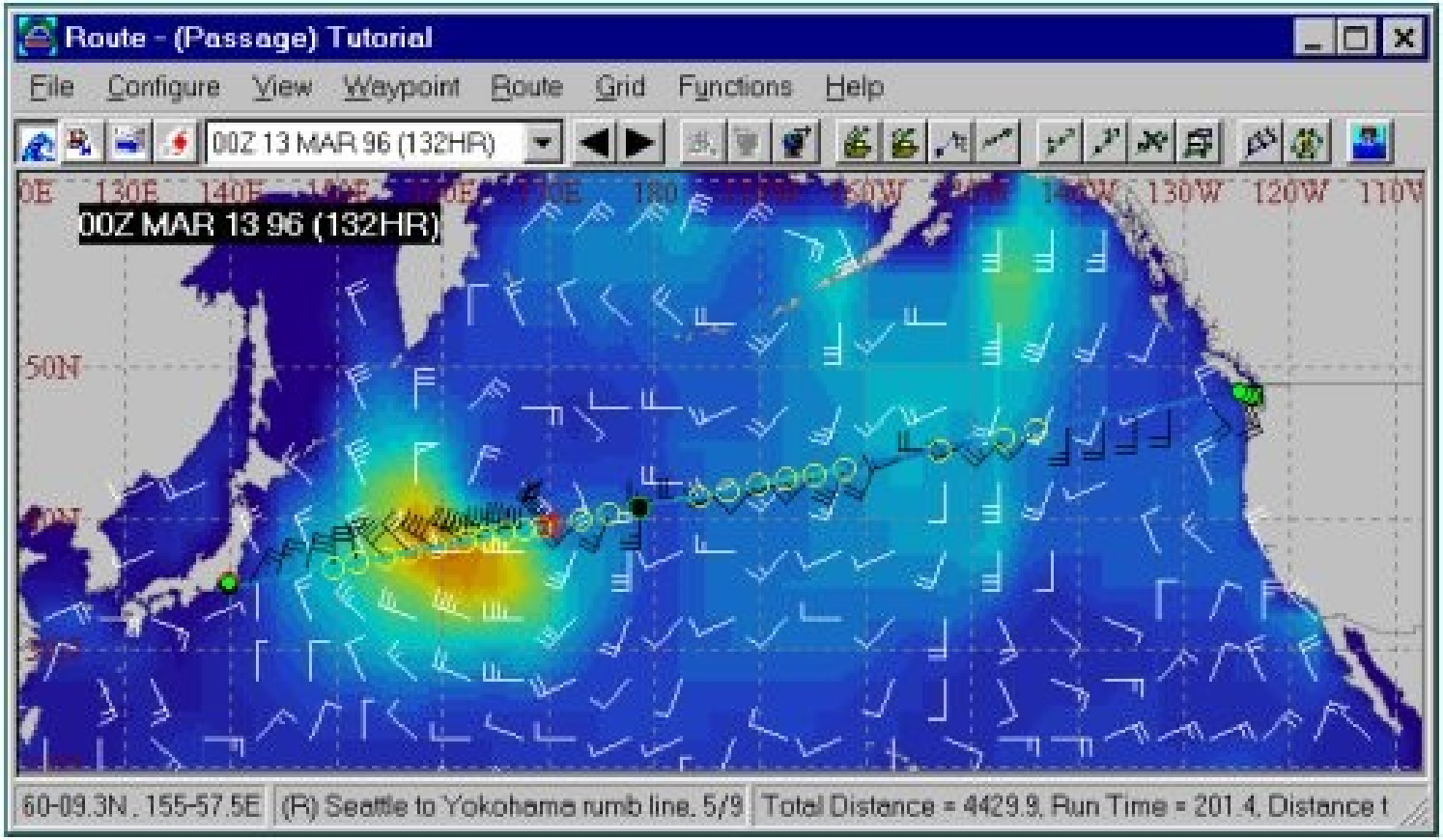

Route - (Passage) Tutorial
File Configure View Waypoint Route Grid Functions Help
12Z 13 MAR 96 (144HR)
12Z 13 MAR 96 (144HR)
00Z 14 MAR 96 (156HR)
00Z 20 APR 99 (024HR)
12Z 20 APR 99 (036HR)
00Z 21 APR 99 (048HR)
12Z 21 APR 99 (060HR)
00Z 22 APR 99 (072HR)
12Z 22 APR 99 (084HR)
130W
120W
110W
50N
60-24.4N , 161-50.4E
(R) test, 1/3
Total Distance = 2260.4, Run Time = 90.4, Distance to Go = 2260.4

Point Weather Forecast Results



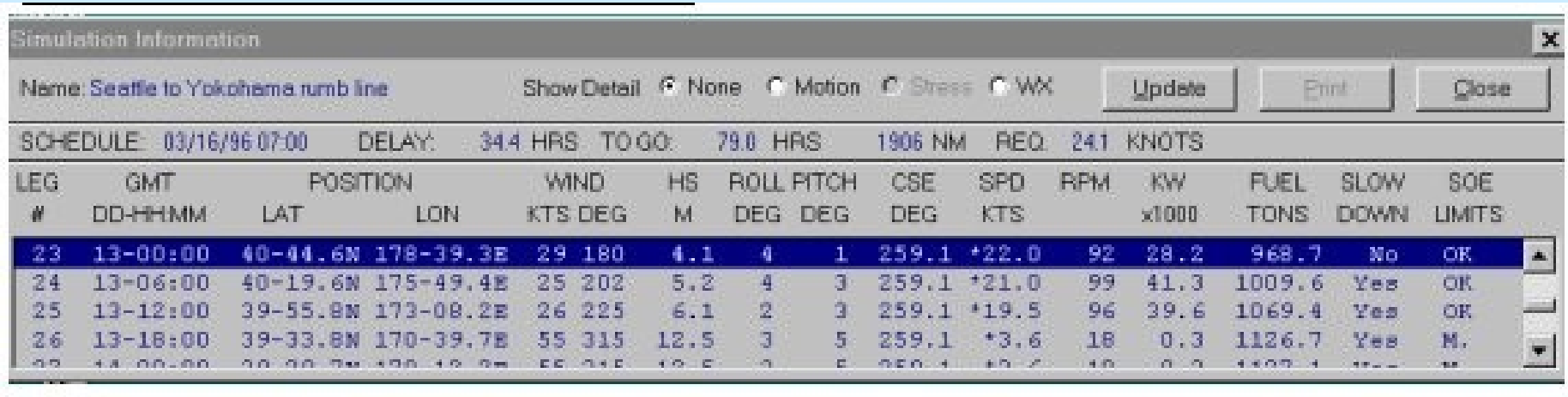
STARS Route Simulation

- Dead reckons ship by simulating route in forecast weather and custom ship response characteristics
- Auto speed reduction when Safe Operating Limits are exceeded


Route - (Passage) Tutorial
File Configure View Waypoint Route Grid Functions Help
00Z 13 MAR 96 (132HR)
00Z MAR 13 96 (132HR)
130E 140E 180 130W 120W 110W
50N
60-09.3N , 155-57.5E
(R) Seattle to Yokohama rumb line. 5/9
Total Distance = 4429.9, Run Time = 201.4, Distance t

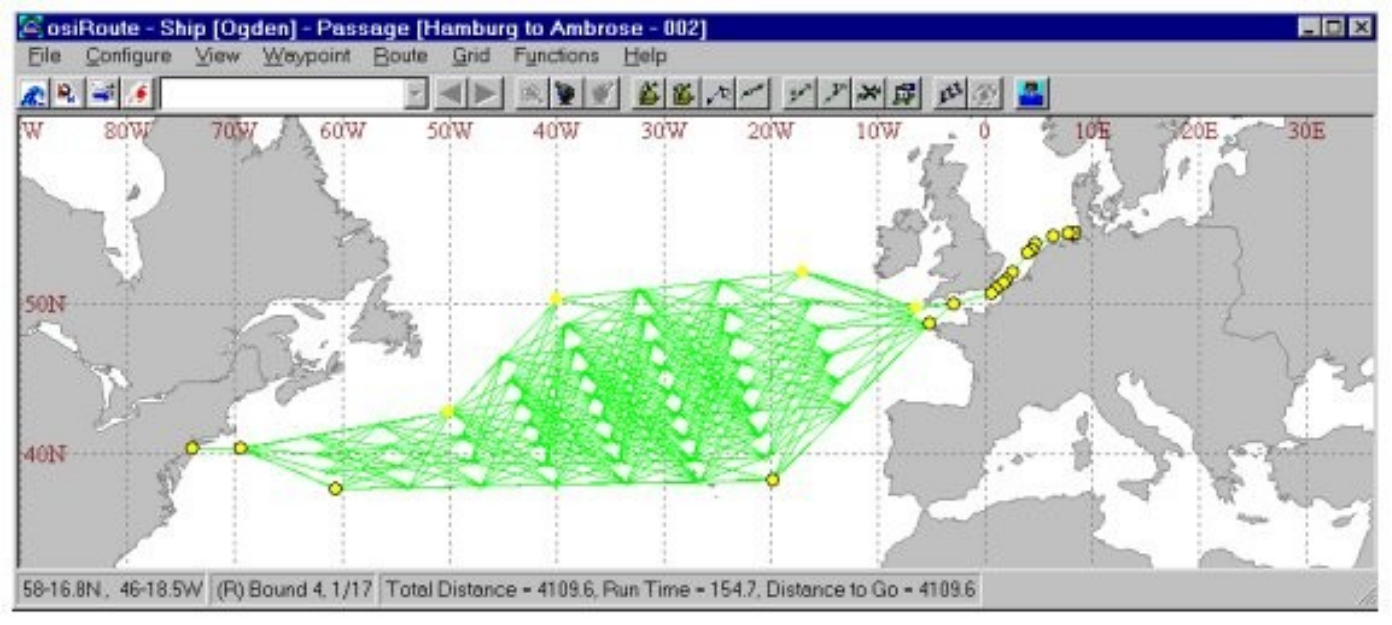
STARS Route Simulation

- Text readout (printable) of simulation data
- Data available every six hours along track

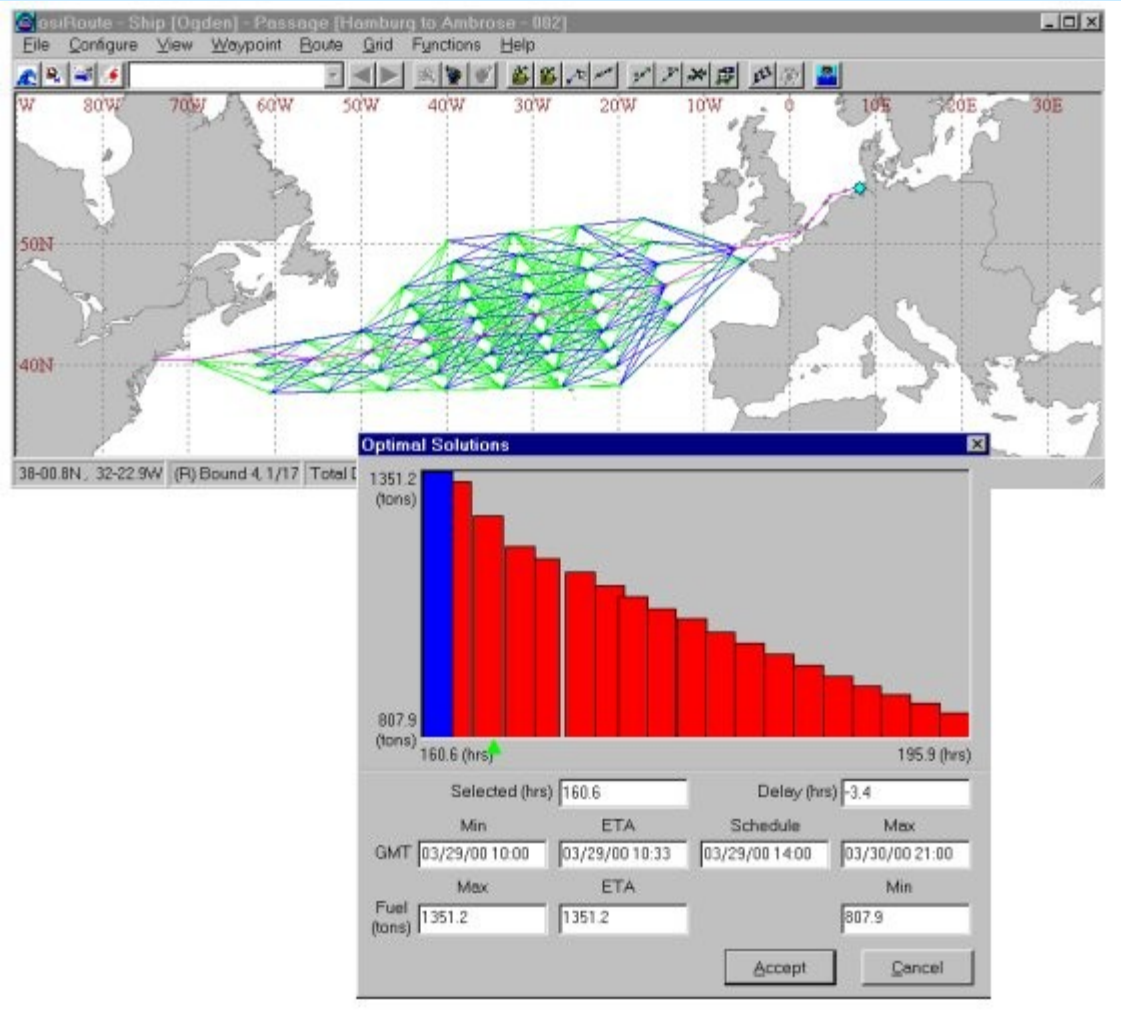

Simulation Information
Name: Seattle to Yokohama rumb line
Show Detail None Motion Stress WX
Update
Print
Close
SCHEDULE: 03/16/96 07:00 DELAY: 34.4 HRS TO GO: 79.0 HRS 1906 NM REQ. 24.1 KNOTS
LEG # | GMT DD-HH:MM | POSITION LAT | LON | WIND KTS DEG | HS M | ROLL DEG | PITCH DEG | CSE DEG | SPD KTS | RPM | KW x1000 | FUEL TONS | SLOW DOWN | SOE LIMITS
23 13-00:00 40-44.6N 178-39.3E 29 180 4.1 4 1 259.1 *22.0 92 28.2 968.7 No OK
24 13-06:00 40-19.6N 175-49.4E 25 202 5.2 4 3 259.1 *21.0 99 41.3 1009.6 Yes OK
25 13-12:00 39-55.8N 173-08.2E 26 225 6.1 2 3 259.1 *19.5 96 39.6 1069.4 Yes OK
26 13-18:00 39-33.8N 170-39.7E 55 315 12.5 3 5 259.1 *3.6 18 0.3 1126.7 Yes M.

STARS Route Optimization

- User-defined grid and value range
- Minimizes fuel use for a range of arrival times while satisfying user-specified Safe Operating Constraints
- Clearly shows danger areas
- First guess for novice ship router

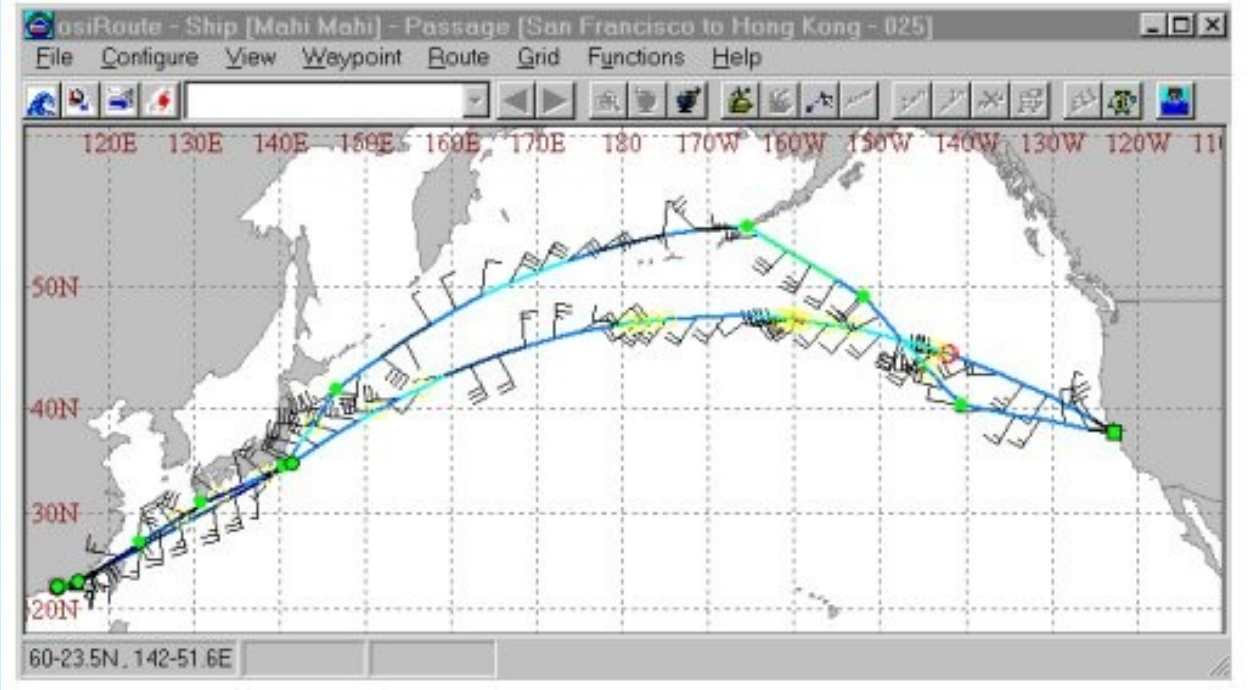

osiRoute - Ship [Ogden] - Passage [Hamburg to Ambrose - 002]
File Configure View Waypoint Route Grid Functions Help
80W 70W 60W 50W 40W 30W 20W 10W 0 10E 20E 30E
50N
40N
58-16.8N, 46-18.5W (R) Bound 4, 1/17 Total Distance = 4109.6, Run Time = 154.7, Distance to Go = 4109.6

STARS Route Optimization Output



Route Comparisons

- Compare two or more routes at once
- Displays differences in distance, maximum ship motions and wave height, and ETA


osiRoute - Ship [Mahi Mahi] - Passage [San Francisco to Hong Kong - 025]
File Configure View Waypoint Route Grid Functions Help
120E 130E 140E 150E 160E 170E 180 170W 160W 150W 140W 130W 120W
50N
40N
30N
20N
60-23.5N, 142-51.6E

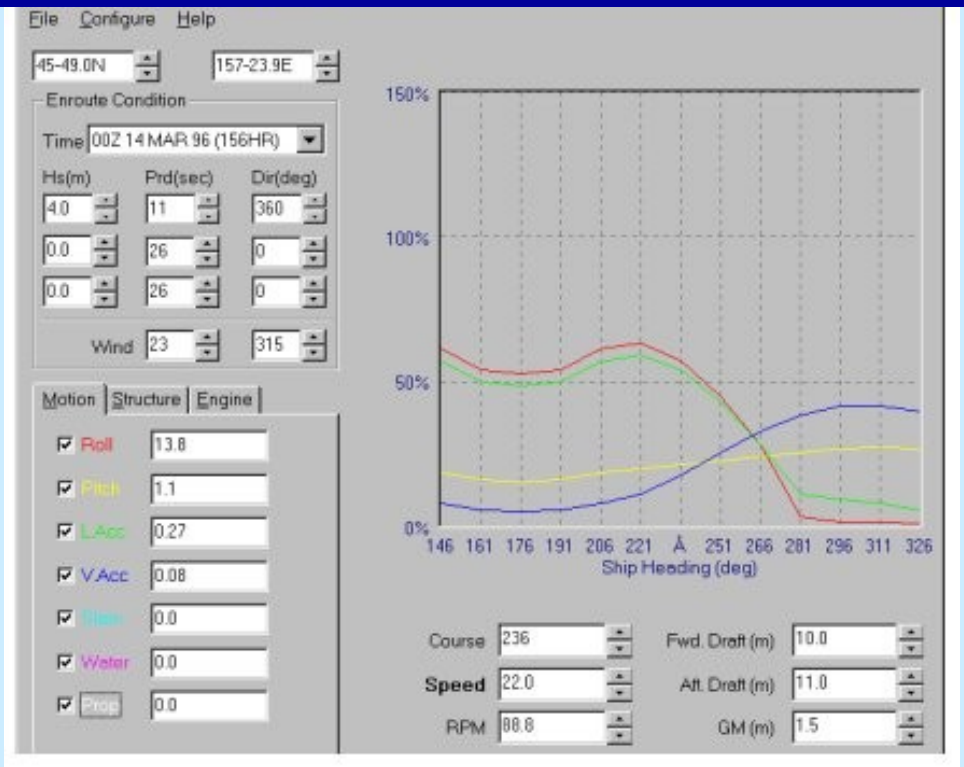
STARS Ship Tracking

- Displays all active routes
- DR through latest wind/wave data
- Separate window prioritizes routes by time remaining until Safe Operating Envelope is exceeded

Ships and Priority
Code Name Passage Priority Last Modified Modified By
T001 Tanker Rotterdam Hou... -4424 12/30/99 00:00 John
C001 Container San Pedro to N... OK 12/30/99 00:00 John
123 Adams San Francisco t... OK 12/30/99 00:00 John
234 Ogden Hamburg to Am... OK 12/30/99 00:00 John
345 Jackson Nojima Saki to ... OK 12/30/99 00:00 John
456 Stout Honolulu to Ka... OK 12/30/99 00:00 John
444 Sharp Oakland to Gua... OK 12/30/99 00:00 John
MON test new vessel voyage to no w... OK 12/30/99 00:00 John
36 xContainer SFO to Honolul... OK 12/30/99 00:00 John
24 Hours
48 Hours
All Ships
Update

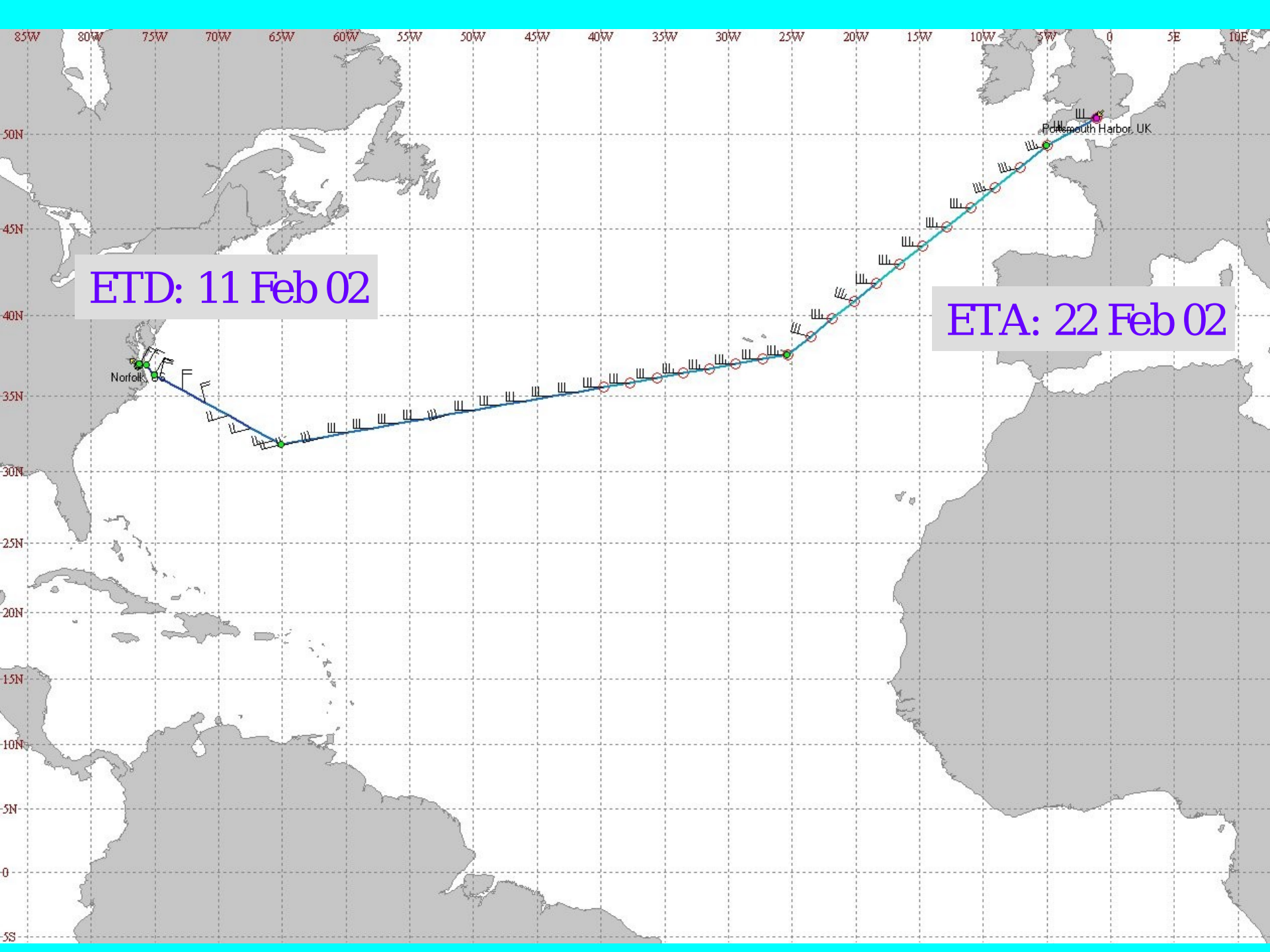
STARS Seakeep Display

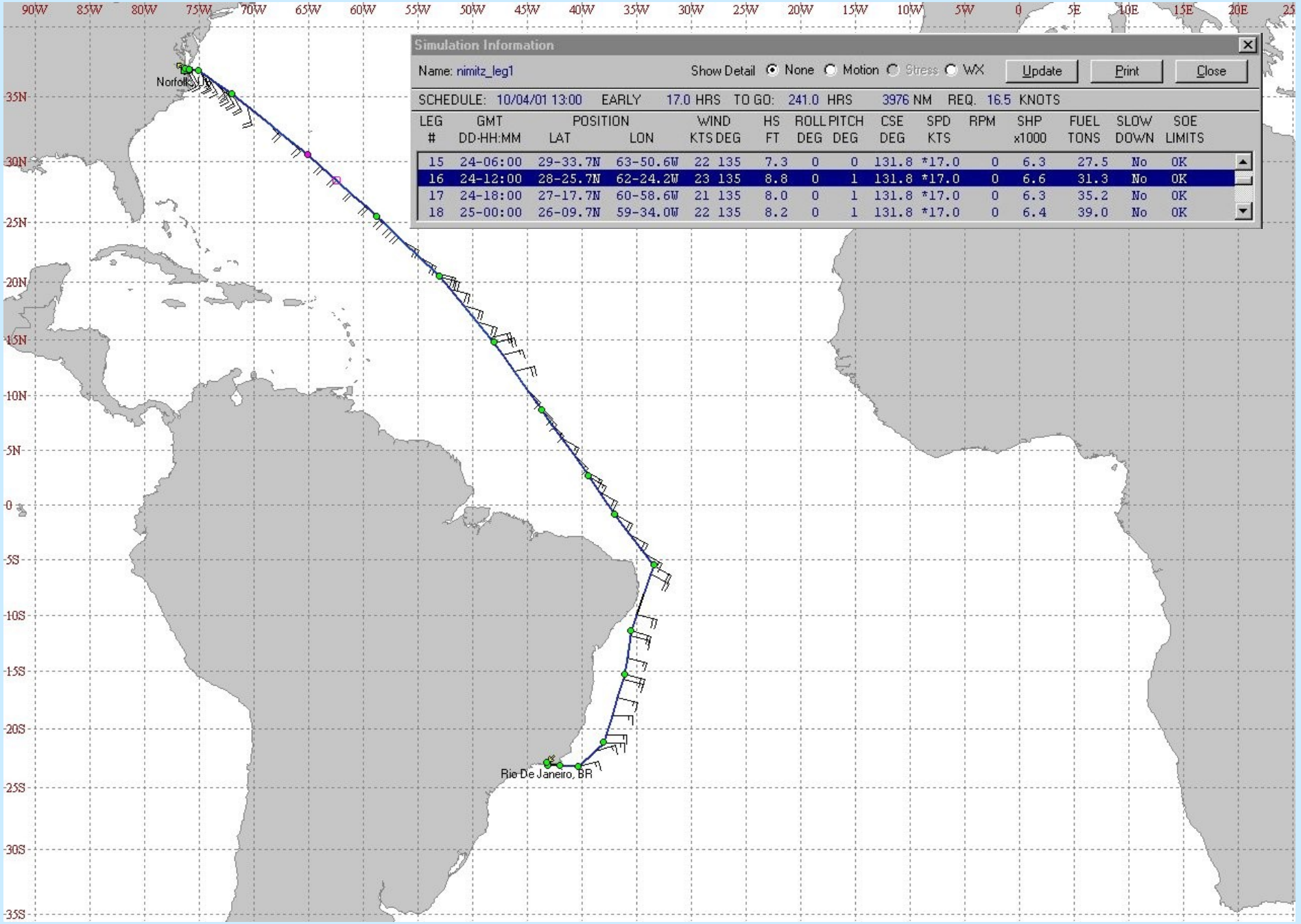
- Basic characteristics generated by Navy's Ship Motion Program
- Predicts motion, load, resistance and engine overload in user specified wind/wave conditions
- Provides "what if" answers before changing heading or speed for damage avoidance
- Tactical routing advice

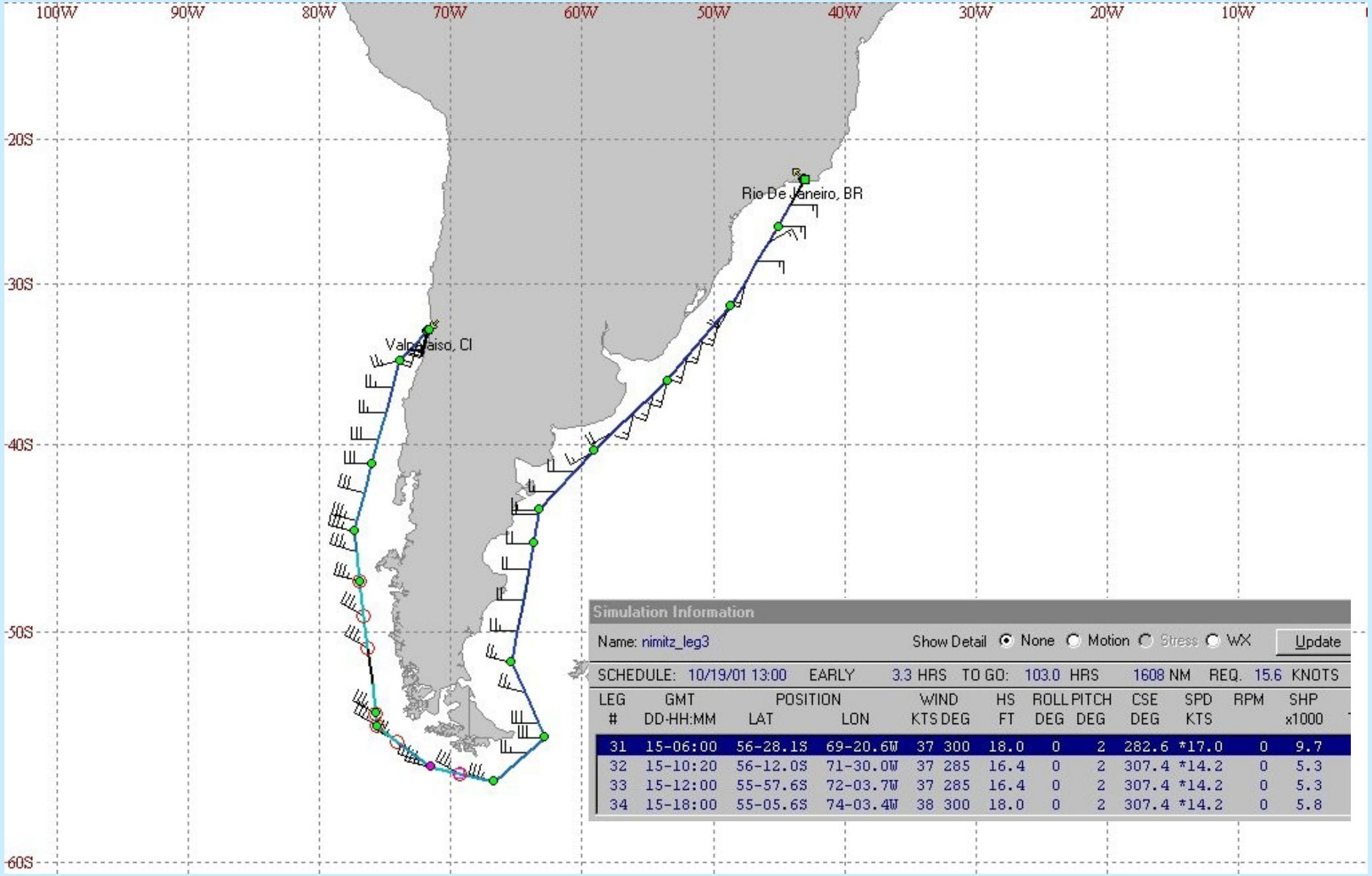


STARS

Mission Planning Examples


ETD: 11 Feb 02
ETA: 22 Feb 02
Norfolk
Portsmouth Harbor, UK
85W
80W
75W
70W
65W
60W
55W
50W
45W
40W
35W
30W
25W
20W
15W
10W
5W
0
5E
10E
50N
45N
40N
35N
30N
25N
20N
15N
10N
5N
0
5S


90W 85W 80W 75W 70W 65W 60W 55W 50W 45W 40W 35W 30W 25W 20W 15W 10W 5W 0 5E 10E 15E 20E 25
35N 30N 25N 20N 15N 10N 5N 0 5S 10S 15S 20S 25S 30S 35S
Norfolk
Rio De Janeiro, BR
Simulation Information
Name: nimitz_leg1
Show Detail None Motion Stress WX
Update
Print
Close
SCHEDULE: 10/04/01 13:00 EARLY 17.0 HRS TO GO: 241.0 HRS 3976 NM REQ. 16.5 KNOTS
LEG # | GMT DD-HH:MM | POSITION LAT | LON | WIND KTS | DEG | HS FT | ROLL DEG | PITCH DEG | CSE DEG | SPD KTS | RPM | SHP x1000 | FUEL TONS | SLOW DOWN | SOE LIMITS
15 | 24-06:00 | 29-33.7N | 63-50.6W | 22 | 135 | 7.3 | 0 | 0 | 131.8 | *17.0 | 0 | 6.3 | 27.5 | No | OK
16 | 24-12:00 | 28-25.7N | 62-24.2W | 23 | 135 | 8.8 | 0 | 1 | 131.8 | *17.0 | 0 | 6.6 | 31.3 | No | OK
17 | 24-18:00 | 27-17.7N | 60-58.6W | 21 | 135 | 8.0 | 0 | 1 | 131.8 | *17.0 | 0 | 6.3 | 35.2 | No | OK
18 | 25-00:00 | 26-09.7N | 59-34.0W | 22 | 135 | 8.2 | 0 | 1 | 131.8 | *17.0 | 0 | 6.4 | 39.0 | No | OK

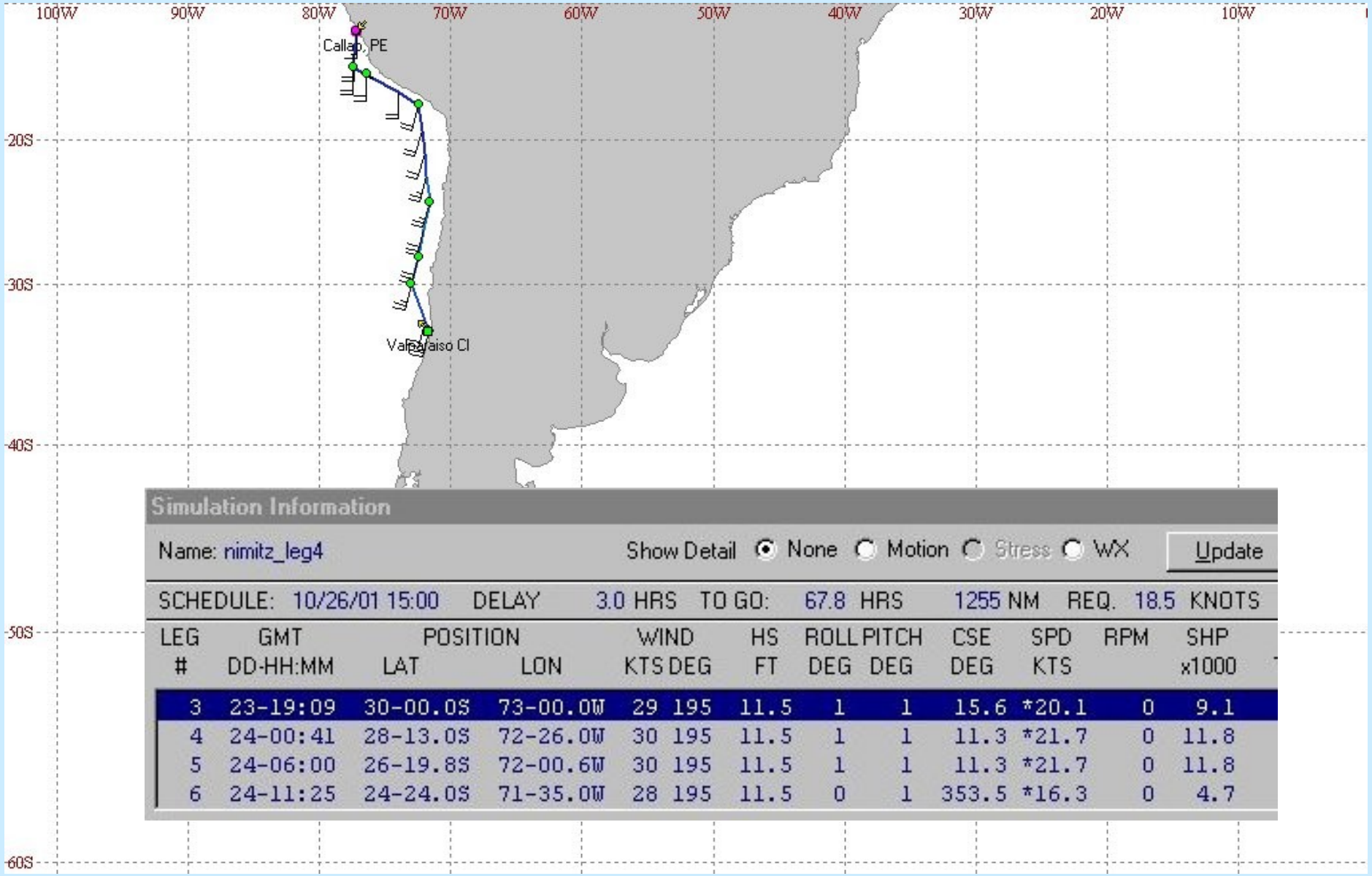


Simulation Information

Name: nimitz_leg3 Show Detail (•) None ( ) Motion ( ) Stress ( ) WX [Update]

SCHEDULE: 10/19/01 13:00 EARLY 3.3 HRS TO GO: 103.0 HRS 1608 NM REQ. 15.6 KNOTS

LEG #	GMT DD-HH:MM	POSITION LAT	POSITION LON	WIND KTS	WIND DEG	HS FT	ROLL DEG	PITCH DEG	CSE DEG	SPD KTS	RPM	SHP x1000
31	15-06:00	56-28.1S	69-20.6W	37	300	18.0	0	2	282.6	*17.0	0	9.7
32	15-10:20	56-12.0S	71-30.0W	37	285	16.4	0	2	307.4	*14.2	0	5.3
33	15-12:00	55-57.6S	72-03.7W	37	285	16.4	0	2	307.4	*14.2	0	5.3
34	15-18:00	55-05.6S	74-03.4W	38	300	18.0	0	2	307.4	*14.2	0	5.8

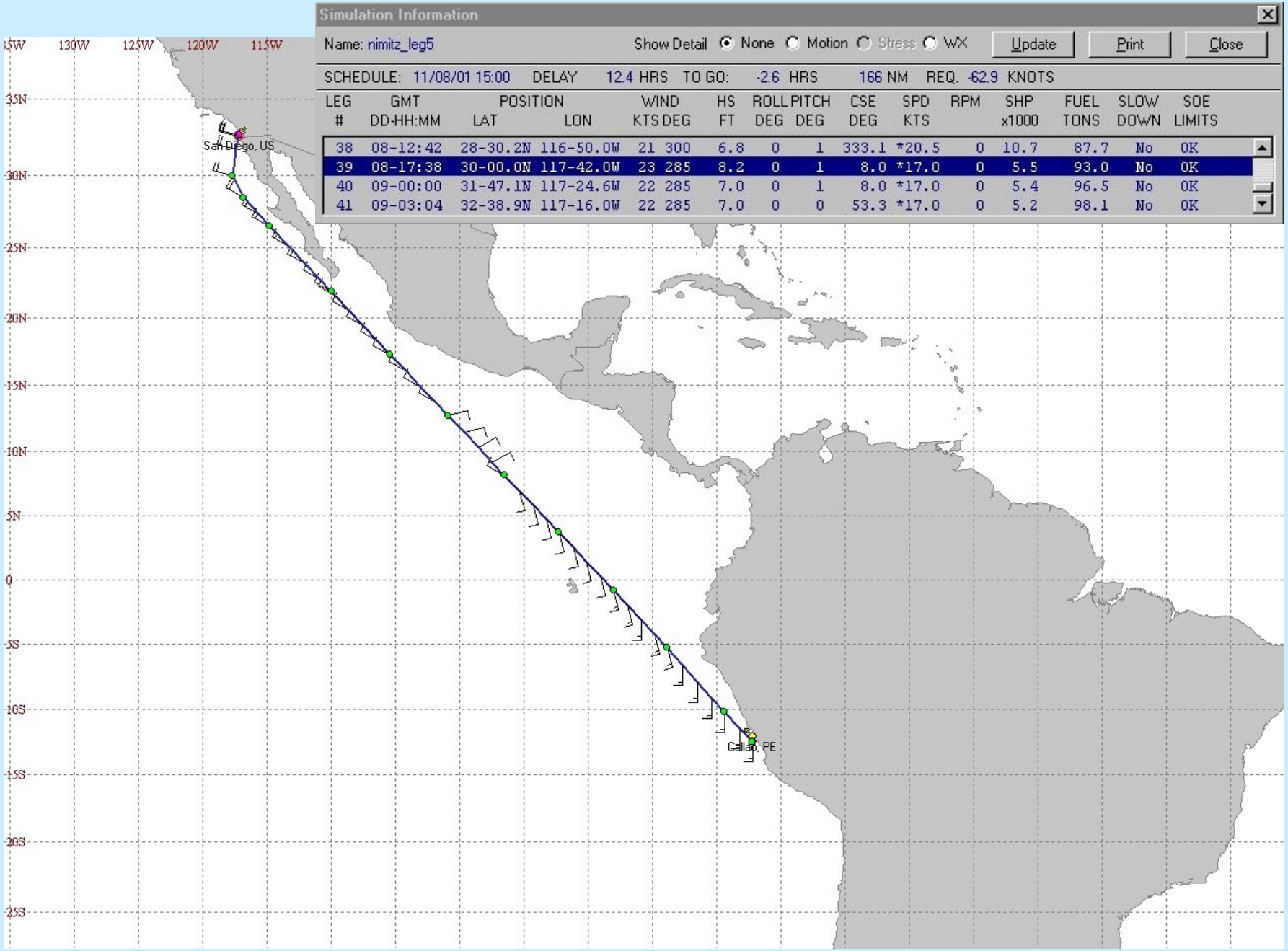


Simulation Information

Name: nimitz_leg4 Show Detail (•) None ( ) Motion ( ) Stress ( ) WX [Update]

SCHEDULE: 10/26/01 15:00 DELAY 3.0 HRS TO GO: 67.8 HRS 1255 NM REQ. 18.5 KNOTS

LEG #	GMT DD-HH:MM	POSITION LAT	POSITION LON	WIND KTS	WIND DEG	HS FT	ROLL DEG	PITCH DEG	CSE DEG	SPD KTS	RPM	SHP x1000
3	23-19:09	30-00.0S	73-00.0W	29	195	11.5	1	1	15.6	*20.1	0	9.1
4	24-00:41	28-13.0S	72-26.0W	30	195	11.5	1	1	11.3	*21.7	0	11.8
5	24-06:00	26-19.8S	72-00.6W	30	195	11.5	1	1	11.3	*21.7	0	11.8
6	24-11:25	24-24.0S	71-35.0W	28	195	11.5	0	1	353.5	*16.3	0	4.7


Simulation Information
Name: nimitz_leg5
Show Detail None Motion Stress WX
Update
Print
Close
SCHEDULE: 11/08/01 15:00 DELAY 12.4 HRS TO GO: -2.6 HRS 166 NM REQ. -62.9 KNOTS
LEG # | GMT DD-HH:MM | POSITION LAT LON | WIND KTS DEG | HS FT | ROLL DEG | PITCH DEG | CSE DEG | SPD KTS | RPM | SHP x1000 | FUEL TONS | SLOW DOWN | SOE LIMITS
38 08-12:42 28-30.2N 116-50.0W 21 300 6.8 0 1 333.1 *20.5 0 10.7 87.7 No OK
39 08-17:38 30-00.0N 117-42.0W 23 285 8.2 0 1 8.0 *17.0 0 5.5 93.0 No OK
40 09-00:00 31-47.1N 117-24.6W 22 285 7.0 0 1 8.0 *17.0 0 5.4 96.5 No OK
41 09-03:04 32-38.9N 117-16.0W 22 285 7.0 0 0 53.3 *17.0 0 5.2 98.1 No OK
San Diego, US
Callao, PE
130W
125W
120W
115W
35N
30N
25N
20N
15N
10N
5N
0
5S
10S
15S
20S
25S

STARS

ip Tracking and Routing Syst

- Represents a paradigm shift for U.S. Navy ship routing. That is: *moving from weather routing by customer-defined environmental limits to weather routing using scientifically-developed hull response and vessel motion limits.*
- Benefits are unequalled by any other software package available to Navy METOC regional centers.
- Routing and Tracking modules display waypoint by waypoint listing of ship position, environmental effects and ship response to these effects.
- Not designed to replace the Joint METOC Viewer (JMV).
- Distributed to Navy METOC regional centers in FY 2002.